

(1.) Course Title: INFPHD614 Computer Graphics (complex exam preparatory)	Credits: 6
Course Classification: Mandatory chosen	
Theoretical or Practical Nature of the Course, 'training character'¹³: 100% theoretical (credit%)	
Type of Class: consultation and number of hours: 2/week in the given semester, <i>(If the course is not (only) taught in Hungarian, then the language: English)</i> Additional (specific) methods and characteristics² used in delivering the knowledge <i>(if any):</i> -	
Assessment Method (Exam / Midterm Grade / Other³): colloquium Additional (specific) methods⁴ applied in knowledge assessment <i>(if any):</i>	
Course Placement in Curriculum (Semester Number): spring semester	
Prerequisites <i>(if any):</i> -	
Course Description: A concise yet informative description of the knowledge to be acquired.	
Introductory topics: Information Technology, Computer Graphics and Geometry. • Color sense, color matching, color schemes, color mapping, materials, spectral image synthesis, material models, textures • 2D image synthesis, vectorization, transformations, 2D cut. Incorporating algorithms, including point, polyhedron collision, cutting • Geometric processing algorithms. triangulation, curve approximation by polygons, approximation of surfaces • Ray casting. Simplified illumination. Reflection and fracture directions. Recursive raytracking. Radius and surface intersection. Acceleration possibilities for intersection calculation. • 3D incremental image synthesis. Graphical pipeline. View transformation. Cutting. Occlusion. Shading. Alias reduction: pre-filtering, post filtering. Texture mapping. Texture filtering. Bump and environment mapping. Shadows. GPUs • Physical laws of realistic motion. Description and interpolation of position and orientation. Motion curves. Keyframe, and track animations. Physical animations: rigid and non-rigid bodies, collision. Forward and inverse kinematics. • Geometric models: meshes, spherical and volumetric models. CSG, geometric primitives, classifications, B-rep, geometric topology. • Bézier curves, de Casteljau algorithm, Bernstein basis. Properties of Bézier curves. Algorithms for Bezier curves: degree incrementation, arc division. • Non-uniform B-splines. Interpolation and its properties. Modelling algorithms for C1 quadratic, C2 cubic, and C1 cubic curves. • Representation of conoids. Rational Bézier and B-spline (NURBS) curves. • Parametric rectangular surfaces: Ferguson, Hermite, Bézier, B-spline patches, Coons interpolation- • Subdivision curves and surfaces. Doo-Sabin, Catmull-Clark algorithms. • Implicit and parametric curves and surfaces. Intersection of surfaces.	
2-5 Most Important Required and Recommended Literature List of required and recommended literature (notes, textbooks) with bibliographic data (author, title, publication details, (possibly pages), ISBN).	

- Farin, G., Curves and Surfaces for CAGD. A Practical Guide, 5th ed., Morgan Kaufmann (2002)
- Foley, J. D., van Dam, A., Feiner, S. K., Hughes, J. F., Fundamentals of Computer Graphics, 2nd ed., Addison-Wesley (1995)
- Hoffmann, C. M., Geometric and Solid Modeling: An Introduction, 2nd. ed., Morgan Kaufmann (1992)
- Szirmay-Kalos László, Számítógépes grafika, ComputerBooks (2000)
- Szirmay-Kalos László, Háromdimenziós grafika, animáció és képszintézis, ComputerBooks (2003)

List of Prescribed Professional Competencies and Competency Elements

(knowledge, skills, etc., KKK Section 8) that the course significantly contributes to developing (highlight the most important ones).

a) Knowledge

- Has a research-level understanding of the general and specific characteristics, major directions, and precisely developed boundaries of the subject area within the discipline, as well as the agreed and debated interrelations.
- Creatively comprehends the interrelations, theories, and conceptual frameworks and terminologies of the given field of study.¹
- Possesses research methodology knowledge necessary for independent research in the given discipline/field.

b) Skills

- Capable of creative analysis of the field, synthesizing comprehensive and specific interrelations with a new perspective, and conducting appropriate evaluative and critical activities.
- Able to apply and further develop the specialized learning and problem-solving methods of the field.
- Can creatively elaborate on the novel, previously unknown practical implications of theoretical issues.
- Capable of planning and executing new projects, conducting research in the field, and developing new techniques and approaches.
- Able to identify unforeseen professional problems and uncover the detailed theoretical and practical background necessary for their resolution at a research level.
- Can construct and communicate new relations relevant to the field, as well as comprehensive interrelations significant for personal and communal existence.

c) Attitudes

¹**Section 108**, Article 37 of the National Curriculum Act (Nftv.) 37. lesson: a session (lecture, seminar, exercise, consultation) requiring the personal involvement of the instructor to fulfil the academic requirements specified in the curriculum, the duration of which is at least forty-five minutes and not more than sixty minutes.

² e.g. case studies, role play, thematic presentations, etc.

³ e.g. continuous debriefing, mid-year report

⁴ e.g. request for case studies, thematic papers, essays, business, organisational plans, etc.

- Represents and further develops the relations that contribute to the process of human self-creation based on the field's characteristics.
- Possesses an interest and learning ability that enable identifying and solving currently unpredictable research problems in the field.
- Demonstrates a firm professional commitment, a continuous dedication to exploring new approaches, and an acceptance of the necessity for persistent effort.

d) Autonomy and Responsibility

- Builds and initiates new knowledge areas with creative independence and proposes new practical solutions.
- Participates in formulating theoretical and practical questions with a leadership role and high-level cooperation.
- Engages as an equal discussion partner with professionals in the field.
- Takes responsibility for raising and addressing new ethical questions concerning theoretical and practical aspects of the profession.

Course responsible (name, position, academic degree): **Dr. Levente Hajder, associate professor**

Instructor(s) involved in teaching the course (if any) (name, position, academic degree): **Dr. Csaba Bálint, assistant professor**